GROUP SUMMARY SP

The Space Systems Academic Group (SSAG) is an interdisciplinary association providing direction and guidance for the Space Systems Engineering and Space Systems Operations curricula. The SSAG relies on faculty and facilities support from the Departments of Aeronautics and Astronautics, Computer Science, Electrical and Computer Engineering, Mathematics, Mechanical Engineering, Meteorology, Oceanography, Operations Research, Physics, and Systems Management. The SSAG also benefits from the support of four Academic Space Chairs: Navy TENCAP Space Chair, Naval Space Technology Program Chair, Navy Space Systems Academic Chair, and Michael J. Smith Space Systems Chair.

The mission of the SSAG is threefold. The SSAG designs the curricula to provide a firm foundation in the broad array of disciplines which comprise the focus for Space Systems Engineering and Space Systems Operations. The SSAG also directs space research at NPS, thereby promoting practical learning opportunities through both theoretical and hardware-based thesis research. The third role of the SSAG is to ensure that officer students in the Space Systems Curricula receive practical experience through experience tours. A six-week experience tour is taken by each officer student hosted by any of a number of facilities from industry, Federal Government, or other universities.

Marrying the academic goals of the SSAG with the practical application of space technology for defense needs, the ongoing small satellite project provides an environment ideal for students to gain experience in design, development, testing, system integration, and operations of spacecraft and payloads. Officer students are exposed to space related research topics as well as formal classroom instruction. Many officer students have chosen research topics directly related to the small satellite design studies program.

In the 1997 academic year, officer students in the Space Systems Curricula and participating faculty from several departments were involved with the Petite Amateur Navy Satellite (PANSAT) project.

1997 SSAG membership includes:

Professor Rudolf Panholzer (Space Systems), Chair
Professor Brij Agrawal (Aeronautics and Astronautics)
Alan Ross (Space Systems), Navy TENCAP Space Chair
Craig Baldwin (Space Systems), Navy Space Systems Academic Chair
Tom Betterton (Space Systems), Naval Space Technology Program Chair
Professor Oscar Biblarz (Aeronautics and Astronautics)
Professor Dan Boger (Systems Management)
Associate Professor David Cleary (Physics)
Professor Donald Danielson (Mathematics)
Professor James Eagle (Undersea Warfare)
Lieutenant Commander D. Farley, USN
Assistant Professor Douglas Fouts (Electrical and Computer Engineering)
Vicente Garcia (Electrical and Computer Engineering), National Security Agency Cryptologic Chair
Professor Ashok Gopinath (Mechanical Engineering)
Lois Scaglione (Space Systems), NASA Michael J. Smith Space Systems Chair
Professor Carl R. Jones (Systems Management)
Visiting Assistant Professor Barry Leonard (Aeronautics and Astronautics)
Professor Herschel H. Loomis (Electrical and Computer Engineering)
Associate Professor Sherif Michael (Electrical and Computer Engineering)
Professor Conrad Newberry (Aeronautics and Astronautics)
Associate Professor Chris Olsen (Physics)
Assistant Professor Michael Ross (Aeronautics and Astronautics)
Instructor Randy Wight Electrical and Computer Engineering)
Commander Michael McMaster, USN, Curricula Officer

SMALL SATELLITE DESIGN STUDIES PROGRAM

Directed by Professor Rudolf Panholzer, the Small Satellite Design Studies Program is part of the Spacecraft Technology research effort incorporating proven and leading-edge technology in a space system development project. The Small Satellite Design Studies project continues in the development of the Petite Amateur Navy Satellite (PANSAT) space system. PANSAT is a small satellite being developed at NPS by officer students, faculty, and staff, for launch into a low-Earth orbit as a secondary payload via the Shuttle Hitchhiker program. Launch and integration is provided by the Department of Defense Space Test Program (STP).

PANSAT will provide digital communications using direct sequence spread spectrum using the amateur radio ultra-high frequency (UHF) band. Communications will be centered at 436.5 MHz with approximately 2.5 MHz of bandwidth. Transmission data rate will be 9.842 kbps using a 7-bit shift register with taps at 7 and 1 for the generation of the pseudonoise (PN) code.

PANSAT will perform store-and-forward message relay, meaning messages received by the spacecraft will be stored on-board until they are commanded to be down-linked to the ground station. This is done autonomously by the spacecraft through its on-board processor and memory. Thorough testing of the electronics and software which controls the on-board processing is currently in progress to ensure a robust system. During the 1997 fiscal year, progress was made in hardware development, software development, mission operations, as well as issues related to flight opportunities and Shuttle integration.

Spacecraft Development

The PANSAT spacecraft consists of the digital control subsystem (DCS), electrical power subsystem (EPS), communications payload (COMM), and the mechanical structure. Progress was made in FY97 in all areas of hardware development. All subsystems have been prototyped and are currently undergoing testing for functionality and software control. Prototype electronics also have been integrated on the benchtop to investigate functionality and control algorithms by software. Specifically, the radio frequency transmit and receive modules were fabricated and undergoing testing, a spread spectrum modem was fabricated and being controlled through a development system, and a processor board is undergoing further functionality testing for control of the other subsystems such as the memory modules. Flight hardware was developed for the memory modules which hold 4.5 megabytes each of storage capacity.

In addition to the progress in electronics development, the spacecraft structure and mechanical systems were completed with the exception of a few mounting hardware items to be finished. Subsystem environmental testing is beginning and a thermal analysis of the PANSAT has started by officer students, LCDR Paul Overstreet and LT Travis Smith, respectively. Software issues for the ground user interface are continuing with work by LT Ken Hunter.

Programmatic Developments

Other progress included an increase in dialogue between NPS, STP, and NASA during the FY97 period for an eventual Shuttle flight. PANSAT was moved to be included in the third International Extreme-ultraviolet Hitchhiker (IEH-3) payload targeted for the STS-95 Shuttle mission. NASA safety issues for PANSAT as a Shuttle payload continued to be worked out between NPS and NASA Safety personnel. A technical interchange meeting was held at NASA Goddard Space Flight Center for all payload experimenters who are part of the IEH-3 on June 20.